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A PECULIARLY PERSONAL ENCYCLOPEDIA: WHAT DESMAREST'S *GÉOGRAPHIE-PHYSIQUE* TELLS US ABOUT HIS LIFE AND WORK

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ABSTRACT

Nicolas Desmarest's *Géographie-Physique*, his contribution to the *Encyclopédie Méthodique*, is a surprisingly useful resource for his biographer. The four volumes he completed during his declining years offer insights into his activities over a long period, such as the extent of his travels, and the sorts of phenomena he selected for observation. Leaving aside those articles that he plagiarized, the many entries he wrote testify to the depth of his commitment to a place-specific construction of a new science of the Earth. In comparison with the article 'Géographie Physique' that he provided for the Diderot-d'Alembert *Encyclopédie* (1757), the components of *Géographie-Physique* also exhibit Desmarest's deepened interest in cultivating knowledge of the Earth's past. Nonetheless his basic conception of physical geography—which he regularly distinguished from both Theories of the Earth and the emerging *géologie* (whose definition he found elusive)—remained centered on a search for law-like generalizations about the natural world's order, rather than its historical development.

1. NICOLAS DESMAREST, PHYSICAL GEOGRAPHER

Nicolas Desmarest (1725–1815) did not want to be called a geologist. Posterity has judged him to have been one all the same. This is reasonable enough, given the unstable meanings of various terms that were used to signify work in the new Earth science that was taking shape during his lifetime. *Géologie* was not really an extant option to classify the sort of science Desmarest did until he was well into middle age, at the earliest, and even then the word was commonly associated with excessively speculative thinking (Ellenberger 1994, p. 250). Always outspoken in favor of disciplined empiricism, Desmarest sometimes appeared less than completely comfortable with any of the available labels for his original researches. While he did not always specify a field within which he thought his scientific work properly belonged, when he did do so his usual choice was 'physical geography', or sometimes 'the natural history of the Earth'.¹ We should pay attention when our historical character signals an aversion to certain words and a partiality toward others. It is part of the biographer's task to show the way toward understanding such preferences. In this paper I sketch out how an under-utilized resource for information on Desmarest's life and work sheds light on the scientific coherence he found in *géographie physique*, and on other biographical problems.

The resource in question is Desmarest's *Géographie-Physique*, his contribution to the gigantic *Encyclopédie méthodique*. Although not his most distinguished or memorable work, it is by far the largest: a set of four volumes that he produced during the closing decades of his

¹ In his earliest writings Desmarest frequently referred to his work as belonging within *physique* and to himself as a *physicien*, as distinct from a *naturaliste* (Taylor 2001). From the 1770s onward, he appeared more reconciled to being identified as a *naturaliste*, but of course this generic association did not connect with any specific scientific field. Within the Paris Academy of Sciences (to which he was admitted to membership in 1771) his official status in the *Classe de mécanique* said little about how to situate his main scientific work, and even his relocation to the newly established category of *Histoire naturelle et minéralogie* in the Academy's 1785 reorganization, while it yielded a general correspondence with his main interests, did not identify him with any particular scientific discipline.

long life, and which began to appear in 1795. (A fifth volume published posthumously in 1828 does not concern us here, as it evidently contains nothing written by Desmarest. The posthumous *Atlas* [1827] is of interest, however, since Desmarest commissioned nearly half of the maps and plates.²) Bearing in mind that this work was conceived as a synthetic compendium, intended as a summation of knowledge in a particular field—to the modern-day book classifier this looks like a reference work—it is surprisingly rich in information about Desmarest himself. This is so not only regarding his opinions, which he expressed freely, but also concerning certain personal details of his life and work.

Whereas the bulky volumes of *Géographie–Physique* marked the closing phase of Desmarest's scientific career, many years earlier a much shorter publication bearing the same title helped establish his scientific reputation. In 1757 his article 'Géographie physique', occupying just over a dozen double-columned folio pages in the Diderot–d'Alembert *Encyclopédie*, certified him as an authority on this subject. It also made novel assertions about the field's subject matter (for example, it was to encompass both the Earth's surface features and its internal constitution) and proposed a programmatic methodology by which advances in understanding should be accomplished (Laboulais-Lesage 2004). The subsequent geological work for which Desmarest became (and remains) most famous, arising out of his field studies in Auvergne—in which he recognized the volcanic origins of columnar basalts, published a remarkable distributional map, and interpreted the volcanic terrain in terms of a succession of distinct epochs—began within the few years after this article's publication. This was all work we have every reason to think Desmarest regarded as belonging within the province of physical geography and indeed as accomplished through application of the basic principles of observation and reasoning that he advocated in that 1757 article. In the *Géographie–Physique* of his waning years he still championed the same methodological principles he articulated in 1757 (the *Encyclopédie* article reappeared there in revised and greatly expanded form as his main pronouncement on physical geography's content and epistemology), but now these were amplified through a multitude of articles on many aspects of terrestrial phenomena.

Because of Desmarest's association with researches in formerly volcanized country, and also because of the polemical emphasis given this by both eulogizers and opponents, for a long time he has been mistakenly characterized as a partisan of a generally igneous geological dynamics.³ One of the benefits of studying his massive encyclopedia is seeing how it undermines portrayals of Desmarest as a doctrinaire Vulcanist. It supports instead a sense of his measured appreciation of varied terrestrial processes and even of his privileging hydrodynamical operations as paramount within the Earth's economy.

Biographers of scientific figures can be seen as facing three sorts of problems: what the historical subjects *did*, what they *thought*, and what contemporary *circumstances* help us understand the significance of those actions and ideas. Scientific works written by the subjects themselves are naturally expected to serve especially the second of these categories: what they *thought*. In this essay, however, I emphasize that Desmarest's *Géographie–Physique* (referred to hereafter as *GP*) also tells us more than a little about his deeds—most specifically about many

² The title page of this large fifth volume of text (xiii + 958 pp., 3 plates), with articles lettered O through Z, retains identification of Desmarest as the series' nominal author, adding that this work was 'continued' by Bory de Saint-Vincent, Doin, Ferry, and Huot. Of these four authors (named in alphabetical order) it was in fact Jean-Jacques-Nicolas Huot (1790–1845) who did most of the work. Huot wrote the introductory 'Avertissement', and his initials are on the great majority of articles, including most of the larger ones, notably 'Ossements fossiles' and 'Roches' (58 pages each), as well as 'Volcans' (162 pages). Huot also provided over 100 pages of 'Supplément' to articles lettered A through N from the earlier volumes. Jean-Baptiste Bory de Saint-Vincent (1778–1846) was responsible for completion of the *Atlas*, providing a lengthy 'Analyse des cartes et des planches' (pp. 4–117).

³ The leading eulogizer was Georges Cuvier (1769–1832), whose necrology for the Institut de France (1819) promoted the theme of his subject as founder of the *système vulcanien* in opposition to Werner and the *neptuniens*. A notable contemporary antagonist was the Rev. William Richardson (1740–1820); see Richardson 1806.

places where he made observations and the *sorts of things* he deemed worthy of examination. It is in this respect that his encyclopedia is a 'peculiarly personal' document. I do not mean to say that personalized exposition of all kinds was unusual in scientific writings of the late eighteenth and early nineteenth centuries, or in the varied topical sets of the *Encyclopédie méthodique* (referred to hereafter as *EM*). A convention of suppression of the scientifically observing actor, what has been called 'aperspectival objectivity', was not yet in general practice in scientific writing during Desmarest's lifetime; it came to be adopted broadly within the sciences only later in the nineteenth century.⁴ But where a custom of giving direct expression to opinions or convictions remained common around 1800, and is abundantly evident in many (although not all) of the subject dictionaries in the *EM*, scientific authors then were already becoming less disposed to emphasize details of their personal observational performance in reports of their experiences, especially in an encyclopedic forum. Desmarest's personal presence is strikingly infused in the text of his encyclopedia in this specific way, and this makes *GP* an unexpectedly valuable biographical resource.

2. THE *ENCYCLOPÉDIE MÉTHODIQUE* AND *GÉOGRAPHIE-PHYSIQUE*

The *EM* was conceived as a thematically-reorganized expansion of the great *Encyclopédie*. Launched by the publisher Charles-Joseph Panckoucke (1736–1798), it had the grandiose aim of encompassing all knowledge under a few dozen headings. Panckoucke lined up specialist editors and set out ground rules to produce a coordinated series, scheduled to appear in regular installments. Subscribers were aggressively solicited, and the *EM* became one of the largest and most lucrative publication ventures ever undertaken. Practical and financial problems soon surfaced, however. While several of the topical sets were completed during the 1780s, by the outbreak of the Revolution many others had only begun to appear, and for some titles, including Desmarest's *GP*, delivery had not even started. In 1794, with difficulties exacerbated by the Revolution, Panckoucke passed the enterprise to his son-in-law Henri Agasse (1752–1813). The huge project—some 216 volumes of text and plates under about fifty headings, with printing farmed out to nearly a score of presses, and delivered in 102 installments—was finally brought to a conclusion in 1832 by Agasse's widow, Panckoucke's daughter Pauline (1769–1843), fifty years after it had started (Braunrot and Doig 1995, Doig 2013).

From the inception of *EM* Desmarest was involved in two of its components. Using his experience as inspector of manufactures, he wrote several articles in *Mechanical Arts and Trades*, a set completed by 1791.⁵ For the series on Physical Geography, though, he assumed sole editorial and authorial responsibility. He had no collaborators, but did it all himself. This was a series initially projected to fill five or six volumes, reflecting Panckoucke's belief in this field's importance. (It was also planned that Desmarest's colleague in the Paris Academy of Sciences, the distinguished naturalist Louis Daubenton, 1716–1799, would produce a separate unit on the natural history of minerals, but this never materialized.)⁶

Desmarest contracted for work on *GP* in 1781, but despite the publisher's periodic assurances to subscribers that it would soon be ready, it was not until the end of 1795 that the first installment came off the presses (see Figure 1). Panckoucke had directed *EM* editors to include historical surveys of their fields. Desmarest dealt with this by assembling almost the

⁴ On 'aperspectival objectivity' see Daston (1992); for objectivity's history more generally, Daston and Galison (2010).

⁵ *Arts et métiers mécaniques*. Among subjects of articles contributed by Desmarest were the design of a silk loom, manufacture of playing cards and cardboard, preservation and preparation of chestnuts, and cheese production. By far the largest (130 pages) and most important of his seven articles was on papermaking.

⁶ *Encyclopédie méthodique*, Prospectus 1781. Another *EM* series in which some concerns in the Earth sciences were addressed was the set on *Chymie, pharmacie et métallurgie*, which the prospectus promised would include treatment of *Géographie souterraine* or knowledge of the position and arrangement of mineral bodies underground and how they are formed.

entire opening volume out of excerpts from the writings of forty authors, mostly from the eighteenth century, with his own remarks on their merits and influence on physical geography and the method of its study.⁷



Figure 1.

Desmarest's *Géographie-Physique*,
Volumes 1–4 (each volume in two parts).
History of Science Collections,
University of Oklahoma Libraries.

The main dictionary portion of *GP* began to appear only after the turn of the century, and at first it made alarmingly slow progress. Volume 2 (the two parts of which appeared in 1804 and 1806)—the first dictionary volume—advanced through just one letter of the alphabet. The next one (1809–1810) accelerated a bit, getting through letter 'D'. Volume 4 (1811–1816), the last one containing Desmarest's work, made it most of the way through letter 'N'. For certain articles, Desmarest recycled some of his own work, published decades before. Inevitably, then, by the time readers got hold of the dictionary, much of it was already out of date.⁸

⁷ Receipts acknowledging payment to Desmarest by Panckoucke and Agasse for his work on *EM* are retained in the archives of the *Académie des Sciences*, Paris (Alfred Lacroix, *Minéralogistes et géologues français*, Vol. 3; and Collection Gabriel Bertrand). Among these receipts the earliest one for work on *GP* (300 livres) is dated 5 February 1783, the latest (200 livres) 11 Vendémiaire An XII (4 October 1803). Among these documents also are three notes that Desmarest wrote to Agasse concerning, among other things, payments for engravings of plates and maps destined for the *Atlas*, and the publisher's provision of books that he needed to accomplish his work.

⁸ The publication history of *GP* is more complicated than can be judged from the dates on the title pages. Each of the four *GP* volumes Desmarest produced appeared in two separate parts, at different times. (There are no printed traces of this division, which could thus go undetected in sets where the two parts have been bound together to form a complete volume.) The dates of delivery of all parts of *EM* are known from notices provided to subscribers, some of them being published in certain *EM* sets (these are tabulated in Evenhuis [2003]). Deliveries of *GP*'s parts were as follows (publication dates as printed on the title pages are shown in square brackets): Vol. 1 [An III {1794–1795}], first part (pp. 1–400) 20 December 1795, second part (pp. 401–858) 20 April 1798; Vol. 2 [An XII, 1803], first part (pp. 1–400) 9 January 1804; second part (pp. 401–896) 6 July 1806; Vol. 3 [1809], first part (pp. 1–384) 9 December 1809, second part (pp. 385–704) 3 September 1810; Vol. 4 [1811], first part (pp. 1–400) 23 October 1811, second part (pp. 401–767) 12 December 1816; Vol. 5 [1828], first part 28 June 1828, second part 29 September 1832. Notable instances of Desmarest reproducing his own published work in *GP* include the articles 'Angoumois' Vol. 2: 610–635; 'Basalte' Vol. 3: 58–65; 'Époques de la nature' Vol. 4: 39–49; 'Fontaine' Vol. 4: 184–210; and 'Montmartre' Vol. 4: 657–667. Portions of Desmarest's commentary in the almost unaccountably long article on 'Sénèque' (Vol. 1: 436–489) consist of critical and explanatory notes he had provided earlier for a translation of the Roman writer's *Natural Questions* (*Les œuvres de Sénèque le philosophe*, by N. de Lagrange. Paris: Frères De Bure, Vol. 6, 1778).

Now, I must report a significant complication: a qualification of my assertion of Desmarest's sole authorship of *GP*. The fact is that a considerable portion of *GP* was plagiarized. I am not speaking here about legitimate presentation of excerpts from historic authors in the first volume. Many of the dictionary articles consist partly or wholly of material lifted from the writings of others, or in some cases adapted with changes. Sometimes this is acknowledged, but for the most part it is not. Through Google searches of selected passages in Volume 2, for example, I judge that approximately eight percent of this volume's text must be seen as borrowed from other sources without attribution. Although my effort to discover how much Desmarest plagiarized has been extensive, it has been by no means exhaustive, and I suspect the actual figure is probably somewhat higher. (See the Appendix for a partial tabulation of articles in the second volume of *GP* that are partly or wholly derived without attribution from other sources.⁹)

Consequently, for any article in *GP* one initially confronts the question whether this is something Desmarest actually wrote, rather than took from another author and passed off, albeit with some changes or adaptations, as his own. Answering this question with confidence is not always easy. Nonetheless, I believe it can be done. The task involves, among other things, checks of an article's consistency with what is known from other sources about Desmarest's actions and ideas, but no less importantly with the tone and substance of the themes and positions developed elsewhere within the *GP* itself. (A few of the ideas guiding Desmarest's approach to physical geography are discussed briefly in Section 4 below.)

The finding that Desmarest's *GP* involved extensive plagiarism is in itself a point of biographical interest. One would like to know whether, beyond retention of textual portions from the original *Encyclopédie*, he intended (as the prospectus implied) that the *GP* would consist entirely of new material. In his own eyes, was his plagiarism a failure and a warrant for embarrassment? I do not plan to pursue such questions here. To do so would require, for one thing, an excursion into the history of the concept of plagiarism, and inquiry into how Desmarest's contemporaries viewed such conduct. It also invites rehearsal of the various pressures that probably led Desmarest to cut corners to meet his overdue contractual obligations for the *EM* (certainly he was a busy man with many other tasks to perform), and reflection on whether the apparently slapdash composition of certain *GP* articles should also be explained in this way. These concerns, worthy though they may be, are for a comprehensive biographical project. Instead, I aim here to illustrate how the articles we can reliably attribute to Desmarest speak to what he did as well as what he thought.

3. OBSERVATIONAL SPECIFICITY

In two separate *GP* articles Desmarest recorded his observation, on 9 February 1764, of the spectacle of the Seine overflowing its banks in one of the worst floods Paris has suffered in modern times. Viewing Paris from the slopes of Chaillot and Passy, he noted that because of works undertaken to build up the embankments upstream from the recently-constructed *Place Louis XV* (later renamed *Place de la Révolution*, and then *Place de la Concorde*), the most conspicuously flooded areas on the north bank lay in the Faubourg Saint-Honoré, where the Seine was deflected southwestward by the high ground joining Montmartre with Chaillot. On the left bank the fluvial plain of Grenelle, and much of the suburb of Vaugirard, were inundated. Similar conditions existed up-river, around the confluence of the Seine and the Marne. Except where artificial barriers prevented it, Desmarest remarked, the river was merely behaving as it

⁹ I am certainly not the first to have noticed that parts of *GP* are copied from other authors. But to my knowledge the extent of Desmarest's plagiarism has not been previously documented as is done here. A noteworthy limitation on using Google to detect plagiarism is, of course, the requirement that historical texts from which passages may have been taken exist in some form in Google Books.

must regularly do, constantly reshaping the bed, which was of its own making. Envisioning the Paris regional topography as the river's own production, Desmarest made clear that periodic flooding of the low-lying terrain is natural, and should occasion no surprise.¹⁰

As an example of Desmarest's observational reportage in *GP*, the case summed up in the foregoing paragraph is unusual in only one respect: its complete specification of the date when he witnessed these events. It may be just coincidence that a majority of the precisely-dated personal experiences I have noticed in *GP* involved the condition of the Seine, whether in flood or at low water, or during the break-up of winter ice-jams.¹¹ While these incidences of fully dated observations are few, it is far more common to encounter *GP* entries where one of Desmarest's observations or experiences is specified by only the year of its occurrence. In a few cases these carry back to the earliest period in his career, the late 1750s and early 1760s, when he was just beginning to involve himself in field investigation. But dates aside, there are hundreds of passages in *GP* where Desmarest alluded to his personal scientific investigations without fixing them in time. Frequently, although not always, these declarations named specific localities. These points deserve the biographer's attention, as they indicate that *GP* can serve as a resource both in determining where Desmarest travelled and, most importantly, in gauging the depth of his investment in a place-specific construction of scientific knowledge.¹²

Some years ago I attempted a sounding of *GP* as a source of details about Desmarest's travels through Italy in 1765–1766 (Taylor 1995). As part of a more recent and comprehensive review, I have counted at least forty-six places in *GP* where Desmarest referred explicitly to his observations in Italy. More broadly, I have tallied assertions in *GP* of his personal experiences in other places. For instance, in relation to his two journeys (1768, 1777) to Holland through Flanders and the Austrian Netherlands I found eighteen such references.

Even more strikingly, Desmarest's direct claims of local experience ranged broadly throughout the entire French kingdom, punctuated here and there by dates from the 1750s to the first decade of the nineteenth century (see Figure 2). Many of these are instances of observations that Desmarest made in familiar territory: in Paris itself and the environs of *Île de France* (I counted fifty references); in his native province of Champagne (22); in Limousin where he spent nearly a decade of summers in government service (28); and of course in Auvergne (25). Others include places where we have separate means of knowing he travelled in the early 1760s: journeys in the Vosges of Lorraine and Alsace (12), in Franche-Comté and the Jura (6); and in

¹⁰ The two articles were 'Débordemens' Vol. 3: 591–593, and 'Inondation d'eau' Vol. 4: 409–410. Desmarest actually gave the full date for his 1764 flood observations only in the second article; in 'Débordemens' the year was omitted. Notwithstanding their order of publication, the article published later ('Inondation d'eau') retained traces of older geographical terminology than the other—*Place Louis XV* and *Chaillot* in 'Inondation', *Place de la Concorde* and *Étoile* (*Chaillot* still being mentioned as well) in the other. This suggests that it cannot be assumed that the chronological order of the *composition* of *GP* articles necessarily followed their alphabetical sequence. The duplication exemplified in these two articles is not uncommon in the volumes of *GP*: the attentive reader grows accustomed to repetitions in different articles.

¹¹ 'Berges' Vol. 3: 111–113 (low water, 30 Fructidor An XI [17 September 1803]), and 'Débacle' Vol. 3: 587–590 (breakup of ice-jams, 21 January 1789). In another fully dated observation, Desmarest wrote of his visit to a chalk quarry in Champagne on 22 June 1780 ('Crenay' Vol. 3: 546–547). There is at least one other dated observation for which the year, while not stated, is readily known nonetheless: a mountain vista in the Apennines on 14 November [1765] ('Agnani' Vol. 2: 203–204).

¹² In the succeeding paragraphs' discussion of tallying Desmarest's explicit assertions of his observations, I have attempted to count only instances of clear and unambiguous claims. Leaving aside those plagiarized portions of *GP* where Desmarest did not take the trouble to eliminate first-person-singular declarations (although it appears he did take such steps more often than not), his rhetorical habits tended to accentuate active observation, but only unequivocal statements such as "I saw" or "I observed" qualify in my count. Excluded from this tally, of course, are the abundant passive constructions ("one observes" or "it is seen that") found throughout. As for specifications of dates, it must be noted that not all the dates encountered in *GP* can be trusted. In a few instances errors may have arisen in typesetting, through misreading of a numeral. This seems plausible, for example, where the year of Desmarest's journey through the Vosges and Franche-Comté was given as 1750 whereas it should have been 1760 (Vol. 2: 48b); and where his passage by Lake Bolsena was fixed in 1769 instead of 1765 (Vol. 3: 61b).

southwest France—Guyenne and Gascony (30), and the western Pyrenees and their foothills (16).

More revealing, because they relate to journeys of which there is less information independent of the *GP*, are references Desmarest made to his observations in Picardy and Artois (7); in Normandy (9), Burgundy (15), the central and lower Loire (Bourbonnais, Nivernais, Berry, Marche, Orléanais, Touraine, and Anjou, 9 references); in Dauphiné and Savoy (12); in the Mediterranean regions of Languedoc, Provence and the lower Rhone (19); and especially in the Atlantic districts of Angoumois, Saintonge, Aunis, and Poitou (33).¹³



Figure 2. France, pre-Revolutionary provinces. Map by May Yuan. Adapted from The Cambridge Modern History Atlas, edited by A. W. Ward, G. W. Prothero, and S. Leathes, New York, Macmillan, 1912, map 79: France before the Revolution.

Evidently during the course of his life Desmarest travelled in every region of France, no doubt benefiting from his obligations as a Government official. In *GP*'s explicit claims of his personal observations, the major province with the lowest tally is Brittany (3); but here as well the *GP* asserts unequivocally that he had toured this province (at one point, for example, reporting Desmarest's observation that the surface of its westernmost section, the *Département*

¹³ Repeated references to Angoumois may be connected with travels Desmarest made from neighboring Limousin to La Rochefoucauld, the country seat of the Duchesse d'Enville and her son the Duc de La Rochefoucauld d'Enville, who were among his most important patrons.

de Finistère, is constituted almost totally of coarse granite).¹⁴ Some of these statements in *GP* provide the only documentation known to me of Desmarest's having seen certain parts of his country. And for many localities, even where his reports are limited to just a few kinds of observations, they record information at a level of detail not known from other sources.¹⁵

Desmarest's *GP* is full of testimony to how highly he rated travel as a path to knowledge, a value he had adopted by 1760 (Taylor 2001, p. 56). 'Physical geography' as conceived by *GP*'s author must be built up from local experience. It aims at finding fruitful generalizations that may lead to an underlying causal understanding and therefore qualify as an explanatory science; but this requires multiplying particular observations made in specific places (Laboulais-Lesage 2004).¹⁶

4. OBJECTS OF OBSERVATION

Possibly even more instructive than the *places* Desmarest's *GP* tells us he went are the *sorts of objects or features* he took the trouble to tell us that he looked at. References of this kind are perhaps even more abundant in *GP* than those identifying particular places where he observed them. The biographical significance of the choices Desmarest manifested, in reports of the features he observed, must be measured in the light of the absence of any general scientific consensus, in the period when *GP* began to appear, about which kinds of terrestrial objects should be the focus of study to secure a comprehensive and reliable science of the Earth's constitution and development.¹⁷ I have no doubt that Desmarest saw himself as a member of a small international cadre of thinkers engaged in a search for the foundations of just such a science.

An effort to inventory the sorts of objects of physical geography Desmarest made a point of observing (the range of which is staggering) is a less straightforward matter than tallying his claims of having made observations in specific localities. In lieu of such an inventory, I venture here—based on long acquaintance with *GP*—to identify four broad categories of phenomena in which a large share of his observations fell. These four concern phenomena related to (italicizing here terms of which Desmarest made particular use):

1. the *constitution* and *distribution* of distinct *massifs* or rock masses
2. the operations of water: *hydrographie* or *hydrologie*
3. mineral resources
4. volcanic phenomena

I concede that these categories are not very much different than they would be if one were simply to attempt to generalize about Desmarest's main preoccupations as seen in *GP*'s articles, regardless of his claims about direct observation; for I believe that on the whole the

¹⁴ *GP*, 'Bretagne' Vol. 3: 223a.

¹⁵ Desmarest's publications apart from *GP* provide substantial information on some of his travels in Auvergne, and to a lesser extent in Limousin. Unpublished correspondence throws additional light especially on his experiences in those two provinces, and in Guyenne and Gascony. The most important biographical document with specifications naming (but not providing details about) his travels is the set of biographical notes prepared by his son Anselme-Gaëtan, evidently to assist Cuvier in composing his *éloge* (*Bibliothèque de l'Institut de France*, Fonds Cuvier, MS 3199).

¹⁶ It must be acknowledged that the commitment seen in *GP* to place-specificity is far from absolute. Desmarest's encyclopedia also contains many rhetorical observation statements, 'fuzzy generalization' fixed in neither time nor place. Sometimes general truths are proposed as evident to anyone who makes proper use of the senses—as in formulations such as 'it only requires eyes' (*il ne faut que des yeux*) in order to recognize a certain point.

¹⁷ To illustrate this contention, call to mind the programmatic differences between Wernerian geognosts centering their efforts on developing litho-stratigraphic sequences, and geological naturalists like Saussure hoping to find the keys to a true Theory of the Earth by discerning regularities in mountain structures. Then add in the new 'biological' approach to stratigraphy, emerging into the light only in Desmarest's last years, exemplified in the work of W. Smith and Brongniart-Cuvier.

range of his declared experiences corresponded closely with the priorities one discerns in the topics and problems to which he mainly attended.¹⁸

Of the four above-stated categories, the first two stand out both in Desmarest's own sense of their importance and the extent to which his *GP* addressed them through assertions of his own observations. So I will expand on these two, with some remarks on the significance he assigned to his observations.

The constitution and distribution of distinct massifs.

As Desmarest made plain in *GP*'s opening volume ('Rouelle' Vol. 1: 409–431), and in various articles of the dictionary as well, his basic approach to the study of the Earth was oriented by what he learned from the chemist–lecturer Guillaume-François Rouelle (1703–1770). In Rouelle's scheme, a *massif* was a coherent rock assemblage possessing characteristic lithological qualities, spread over regions of considerable extent. Rouelle saw as fundamental the distinction between the *ancienne terre* (literally 'old Earth') and the *nouvelle terre* ('new Earth'), the first of which was typified by deeply based massive polycrystalline rocks (granites, gneisses, schists), and the second by overlying stratified and fossil-bearing rocks. This was much the same—as Desmarest acknowledged—as the systems proposed by Giovanni Arduino (1714–1795) and by J.-G. Lehmann (1719–1767), demarcating *primary* or *primitive* 'mountains' (*monti* or *Gebirge*, as miners traditionally styled rock masses) from *secondary* ones.

GP is replete with observational references to charting out the positions of these *massifs* and *terres*. In fact, Desmarest used *GP* to record his personal participation in enlarging and improving Rouelle's system. With evident pride Desmarest lets us know how he and another of Rouelle's students (A.-R.-J. Turgot, 1727–1781), in applying their master's teachings in the field in Limousin, realized that in addition to the *ancienne* and *nouvelle terres* an additional intermediate one needed to be added, a *travail intermédiaire* or *moyenne terre*. Desmarest reported also on the gratifying alacrity with which Rouelle accepted this embellishment of his scheme.¹⁹

A point of special interest in many *GP* articles was the observational task of plotting the *limites* or boundaries between these fundamental *massifs*. Desmarest pointedly insisted on the necessity of a disciplined and laborious inquiry in the field to accomplish this. He expressed disdain for the failings of his contemporary and rival Jean-Étienne Guettard (1715–1786) as a cartographic observer of the *massifs* and their boundaries. Guettard made the mistake, he said, of traversing ground in linear point-to-point stages, thereby missing opportunities to establish the otherwise elusive *limites*. In 1772, he wrote, Desmarest devoted special effort to mapping these boundaries in the Morvan of northern Burgundy (leading evidently to the map marking those *limites* that appeared in the posthumous *Atlas*, Map No. 25).²⁰

Another significant term in Desmarest's examination of elements of the Earth's constitution was *amas* ('Amas de coquilles fossiles' Vol. 2: 346–354). Although this word was occasionally used to mean any large terrestrial accumulation (thus in some contexts it was a

¹⁸ There is one significant exception: the extent to which certain articles in *GP* address living things (plants and animals, human beings included) in relation to their natural habitats, sometimes emphasizing adaptation to changes in habitat. (One unusually long article, 'Aclimater' Vol. 2: 79–148, is centered on the 'naturalization' of plants, their adaptation to conditions in places distant from their natural habitat.) Within this broad sphere one finds Desmarest asserting his direct observational involvement in regard to agricultural matters (e.g., 'Abri' Vol. 2: 22–27; 'Climats agraires' Vol. 3: 431–432; 'Cultures' Vol. 3: 574–576), but little else. Thus while incorporation of the human species within nature is one of *GP*'s noteworthy features (Blanckaert 2006), for the most part this was not a subject where Desmarest's articles reveal his own personal observational engagement.

¹⁹ *GP*, 'Rouelle' Vol. 1: 412–413; 'Ancienne terre' Vol. 2: 498–512 (at p. 499).

²⁰ On the Earth's constitution in *massifs*, and their *limites*, *GP* articles include 'Additions successives faites au globe de la terre' Vol. 2: 153–154; 'Ancienne terre' Vol. 2: 498–512; 'Couches de la terre' Vol. 3: 500–508; 'Craie' Vol. 3: 524–536; 'Limites de l'ancienne et de la nouvelle terre' Vol. 4: 512–513; 'Massifs terrestres' Vol. 4: 576–578; 'Montagne' Vol. 4: 737–748; 'Morvan' Vol. 4: 674–6. On Guettard's shortcomings: 'Guettard' Vol. 1: 151–188 (esp. 151, 154, 160). On Desmarest's mapping in the Morvan, see Vol. 1: 160.

synonym for *massif*), in *GP amas* was applied most often in a special way—in a usage borrowed, again, from Rouelle, and evidently seconded by Bernard de Jussieu (1699–1777)—to refer to sedimentary rocks characterized by recognizable groupings or *sociétés* of specific marine fossil shells. Desmarest enumerated seven different classes of *amas*, all of which he had seen in field exposures in various parts of France. In this concept of *amas*, remnants of such assemblages of different species regularly found together were taken as representing consistent seabed environments of the past. This ‘population’ concept had a formal similarity to the way that contemporary naturalists recognized specific geographic distributions of certain distinctive plant communities, but it transported the observer to conditions of the past. Tracts of such *amas* marked the former presence of the sea; their margins showed the contours of former *golfs* extending over what is now dry land.²¹

One sees in Desmarest’s emphasis in *GP* on observing the distributions of *massifs* and *amas*, and on locating their extent and boundaries, his particular fascination with demonstrating past incursions and retreats of the sea as fundamental to a satisfactory understanding of the Earth’s ‘physical constitution’, the gross distribution of different rock types. In these inquiries, as with many of the objects of Desmarest’s interest, a motivation for ascertaining the present state of affairs was the light it could shed on the past, when placed in the right interpretive framework.²²

Hydrographie.

The second of the two most comprehensive classes of Desmarest’s observations had to do with *hydrographie* or *hydrologie*—again, his own words—by which he meant broadly the circulation of water within the Earth’s economy, and the consequences of these movements. Of all the objects of Desmarest’s observation as recorded in *GP*, nothing exceeded his interest in features associated with the movement and action of water both above and below ground (without total neglect for the atmospheric section of its cycle), but especially the operations of rivers, a subject he occasionally dubbed *potamologie*. He attended to the gradients and changes of river direction, the forms of their banks, their seasonal variations, and their susceptibility of disappearing underground and reappearing elsewhere. *GP*’s treatment of hydrography was typically dominated by Desmarest’s fascination with the “destructions and immense transports” effected by moving water, with the configurational geometry of river features, with successions of erosive alterations over long periods of time (in effect a ‘fluvialistic geodynamics’), and with a time-conscious reconstruction of past conditions, working backward from the present. Also conspicuous within his hydrographic range of interest were lakes and their basins (given his fluvialist convictions, some explanation of these was required).²³

²¹ Desmarest’s development of the Rouellian notion of *amas de fossiles*, as distinctive groupings of shellfish species characteristic in specific deposits, represented an essentially *distributional* conception, not a *temporal* one. It had to do with correlations understood essentially in geographic or horizontal terms, rather than in vertical arrangement. In this crucial respect it differed from the idea of fossil assemblages characteristic of specific stratigraphic formations which was soon to become central within geology. Notwithstanding this vital difference, however, this serves to remind us that the ideas developed by William Smith, and by Cuvier and Alexandre Brongniart, were historically grounded in an extended scientific discussion about fossil life forms exhibiting a correlation with the rocks within which they were found. See Ellenberger (1994, pp. 244, 298–301).

²² Among other *GP* articles bearing on these objects of study: ‘Abaissement des mers’ Vol. 2: 3–7; ‘Age des continens’ Vol. 2: 196–199; ‘Ammites’ Vol. 2: 482–483; ‘Ammonites’ Vol. 2: 488–489; ‘Golfs terrestres’ Vol. 4: 296–298; ‘Invasion de la mer’ Vol. 4: 411–412.

²³ Some pertinent ‘hydrological’ observations are seen in: ‘Adige’ Vol. 2: 155–159; ‘Affluence’ Vol. 2: 182–184; ‘Allier’ Vol. 2: 292–295; ‘Angle de confluence’ Vol. 2: 593; ‘Angles correspondans des vallées’ Vol. 2: 590–593; ‘Angoumois’ Vol. 2: 610–635; ‘Ardèche’ Vol. 2: 746–750; ‘Auteuil’ Vol. 2: 873–876; ‘Bassins des rivières de France’ Vol. 3: 68–73; ‘Bords des rivières & côtes’ Vol. 3: 182–183; ‘Changemens à la surface du globe’ Vol. 3: 363; ‘Charente’ Vol. 3: 385–386; ‘Circulation des eaux’ Vol. 3: 419–420; ‘Croupes de montagnes, de collines’ Vol. 3: 567–568; ‘Déblais’ Vol. 3: 590–591; ‘Dégradation des montagnes’ Vol. 3: 600–603; ‘Déplacemens & transports’ Vol. 3: 615–618; ‘Dordogne’ Vol. 3: 660–663; ‘Eau’ Vol. 4: 1–12; ‘Isle’ Vol. 4: 424–429. “Destructions and immense transports” is from the Prospectus, pp. 104–105. On lakes: ‘Bassins des lacs’ Vol. 3: 73–74; ‘Lacs’ Vol. 4: 471–476.

Desmarest's evident captivation by underground water movement (central to problems he had addressed in his long article 'Fontaine' in the same volume of the original *Encyclopédie* where 'Géographie physique' appeared) found expression in numerous reports in *GP* on observations not only of springs but also of caves and of points where rivers vanished underground to reappear nearby.²⁴ But the greater part of his attention was on surface features that reveal something about the dynamics of water in shaping the terrain. For example, among Desmarest's favorite 'hydrographic' objects of observation were alternately paired features of river banks he called *bords escarpés* (steep banks, which adjoin a river on the outer or convex side of a river-course bend) and *plans inclinés* (sloped planes, on the inner or concave side of the meander). These features correspond closely to what modern analysts of river morphology call *cut banks* and *point bars*, respectively (Carozzi 1986).²⁵

Through his observations of the morphological components of rivers and their banks, more than any other class of terrestrial phenomena, it is perhaps easiest to see Desmarest's strategy of assembling information on selected natural effects, with a view toward linking these with their causes, in hopes this would lead in turn to more fundamental explanations of transformations the Earth has undergone. Elsewhere I have discussed this investigatory strategy as centered on identification of key 'dispositional regularities' (Taylor 1988, 2002). As with the phenomena of the Earth's surface constitution, the hydrographic side of Desmarest's preoccupations lent itself to his characteristic temporal imagination, as through fluvial geomorphic analysis he envisioned terrain having undergone stage-wise transformations.²⁶

In broad perspective, these two categories of Desmarest's special observational interest—*constitution physique*, and *hydrographie*—encompass a sizable fraction of his assertions about his own investigations. (They also represent the topics where his capacity for integrative thinking is most clearly on display.) The two other main classes of phenomena that I have mentioned account for markedly fewer of his observation claims, but these represent a tangible share of his interests nonetheless. Many *GP* articles are indicative of Desmarest's personal visits to mines and quarries (notably for coal, slate, stone for construction, chalk, gypsum). His observations attended to questions about the distribution of mineral deposits in relation to enveloping rock masses, and to the role of fluid infiltration in the processes by which some of them had been formed.²⁷ Among volcanic phenomena, naturally an area of Desmarest's sustained interest, he reported on the geographic distribution of volcanic action, varieties of volcanic products, comparison of active volcanic effects with those of past productions (now decomposed in varying degrees), and thermal manifestations such as hot springs and gas vents.²⁸

²⁴ Among *GP* articles bearing on underground *hydrographie*: 'Absorbans (Cantons)' Vol. 2: 27–58; 'Affaissement des terrains & des couches de la terre' Vol. 2: 176–179; 'Aqueducs naturels et souterrains' Vol. 2: 700–702; 'Arcy (Grotte d')' Vol. 2: 740–746; 'Balme du Dauphiné' Vol. 3: 18–21; 'Cavernes & grottes' Vol. 3: 325–326; 'Drôme' Vol. 3: 670–671; 'Entonnoir' Vol. 4: 37; 'Filtration' Vol. 4: 171; 'Grottes' Vol. 4: 324–327; 'Infiltration' Vol. 4: 408.

²⁵ On *bords escarpés* and *plans inclinés* see, for example, 'Acclivité' Vol. 2: 60; 'Accrues' Vol. 2: 60–61; 'Alluvion' Vol. 2: 296–297; 'Amont' Vol. 2: 489; 'Anecdotes de la nature et de l'histoire de la terre' Vol. 2: 532–586, esp. 541–542, 560, 568–571; 'Angles correspondans des vallées' Vol. 2: 590–593, esp. 593; 'Angoumois' Vol. 2: 610–635, esp. 619; 'Auteuil' Vol. 2: 873–876; 'Berges' Vol. 3: 111–113; 'Bords des rivières & côtes' Vol. 3: 182–183; 'Cap ou promontoire' Vol. 3: 281–282; 'Croupes de montagnes, de collines' Vol. 3: 567–568; 'Eau' Vol. 4: 1–12, esp. 3; 'Fleuve' Vol. 4: 175–180; also in the *Atlas*, esp. Plates 15, 16, and 17.

²⁶ Especially in 'Époques de la nature' Vol. 4: 39–49; also 'Analyse du globe de la terre' Vol. 2: 493–497, 'Champagne' Vol. 3: 352–360 (esp. 356–357), and 'Isles terrestres' Vol. 4: 431–433. See Taylor (2009).

²⁷ 'Albâtre' Vol. 2: 256–260; 'Ardoise' Vol. 2: 752–757; 'Ardoisière' Vol. 2: 757–762; 'Charbon de terre ou houille' Vol. 3: 366–384; 'Dessiccation' Vol. 3: 638–640; 'Filons' Vol. 4: 165–171; 'Infiltration' Vol. 4: 408.

²⁸ 'Auvergne' Vol. 2: 878–884; 'Basalte' Vol. 3: 58–65; 'Bullicames' Vol. 3: 240–245; 'Cheminées des volcans' Vol. 3: 405–407; 'Courans des volcans' Vol. 3: 518–519; 'Cratère' Vol. 3: 539–540; 'Culots' Vol. 3: 571–574; 'Feu des volcans' Vol. 4: 162–164; 'Montamiata' Vol. 4: 650–653; 'Naples (Royaume & ville de)' Vol. 4: 684–688.

One final comment about the objects of Desmarest's observations in *GP*: He tended to treat the careful reading of maps almost as a kind of empirical exercise in itself. Just as he liked to say that knowledge in the field of physical geography should be susceptible of reduction to cartographic form (he sometimes emphasized the utility of sections or *coupes* as well), his use of information derived from maps sometimes suggests that he thought of consultation of maps as an extension of his direct observation of nature. While an attentive reader sees Desmarest distinguishing clearly enough between knowledge he drew straight from nature and what he found in maps, it is evident that he considered it possible to make inferences about geological processes based on cartographic data.²⁹ *GP* shows his great trust in maps. In this way, too, Desmarest revealed confidence in the collective scientific process of visual generalization, whereby physical geography grows through synthesis of a multiplicity of observations in widely dispersed places.

5. THE GOALS AND METHODS OF PHYSICAL GEOGRAPHY

In considering the objects Desmarest examined as a physical geographer, in conjunction with the significance he found in them, inevitably we find we are no longer discussing his deeds alone; we have entered the vast zone of intersection between what he *did* and what he *thought*. I will close with some remarks on how *GP* shows what sort of discipline Desmarest understood *géographie physique* to be, and how it proved to be a largely satisfactory vehicle for his scientific agenda.

Commentators have called attention to the cognitive distance between Desmarest and his geographical contemporaries (Laboulais-Lesage 2004, 2006). Although the *EM*'s initial plans called for Desmarest's *GP* to be identified principally with natural history, for whatever reason the series title was simplified (with 'natural history' stripped out) and this linkage weakened.³⁰ Nonetheless, the contents of *GP* reflect an author more concerned to situate himself and his subject in relation to physical science and natural history—especially to Theories of the Earth—than to contemporary traditions of geography.

One of the most conspicuous elements of *GP* is an urgent focus on method, which at least in Desmarest's case went far toward embodying a disciplinary self-consciousness. This is true especially of the opening volume, where by the publisher's design the nature of the knowledge at issue and how it should be pursued were at the center of attention; but these concerns are evident in many of the individual dictionary articles as well. On the whole Desmarest tried to keep *géologie* at arm's length and to frame physical geography as having a *marche*—a manner of approach and treatment—sharply opposed to the traditions of Theories of the Earth. On the other hand, there is scant guidance in *GP* for understanding how Desmarest considered *géologie* to be defined (in one key passage he avowed ignorance of the principles of this "new science" and of the "observations it can have controlled").³¹ And while it is true that remarks dismissive

²⁹ An article where information is drawn from maps is 'Absorbans (Cantons)' Vol. 2: 27–58. Instances of reasoning from data in maps include 'Changemens à la surface du Globe' Vol. 3: 363, where he concluded from the study of maps of estuaries that river action contributes to the detachment of islands from coasts; 'Arêtes' Vol. 2: 764–775, where general topographic patterns emerge from map study (at 764a); and 'Berru' Vol. 3: 126–128, where maps are a resource in judging a portion of the terrain near Reims to be a remnant of a greatly eroded *massif* that formerly covered the region. One of the ways Desmarest enlarged his 1757 article on physical geography, in *GP*, was by addition of a lengthy section 'on maps suited to physical geography' (Vol. 1: 803–808).

³⁰ In the *EM* prospectus, *GP* was positioned as the last of four series in natural history: (VIII) *L'histoire naturelle des animaux*; (IX) *La botanique*; (X) *L'histoire naturelle des minéraux*; and (XI) *L'histoire naturelle, contenant la géographie-physique ou les phénomènes généraux de l'histoire naturelle de la Terre*, followed immediately (XIII) by *La géographie ancienne et moderne*.

³¹ *GP*, 'Considérations générales et particulières sur la géographie physique' Vol. 1: 792–842, at 842b. Note that in *GP* *géologie* and Theories of the Earth are different things. It is interesting that in the fourth and last of the *GP* volumes on which Desmarest worked, one encounters the term *géologie* (or its cognates *géologue* and *géologique*) more times than in all the previous three volumes together, and for the most part in constructions suggesting no necessarily pejorative association. Perhaps Desmarest's sour view of *géologie* was moderating a little in his final years.

of systems and comprehensive theories abound in *GP*, close examination of how he treated individual works exhibiting sympathies for Theories of the Earth suggests a more equivocal attitude and an eclecticism based on apprehension of the value extractable from the components of some theories. And he thought that in the course of time a fully developed physical geography should eventually make possible the realization of the goals of Theories of the Earth.

There is a broad consistency between the way Desmarest charted out the aims and methods of physical geography in his 1757 *Encyclopédie* article and the way these were expressed in *GP*. From 1757 to the end of *GP* he held steadily to a broad canvas of the field's subject matter—the Earth's internal and external features, the processes (*opérations*) that participate in its economy, on occasion approaching an embrace of practically the entire 'spectacle of nature'. He was also constant regarding method, always advocating an active empiricism whereby terrestrial phenomena were to be approached through close inspection (*interrogation*), in contrast to the meditative exercise of scholarly imagination or abstraction; and with the high objectives of using observations inductively to build a structure (*un édifice*) of generalization eventually culminating in explanatory knowledge.

One area where the totality of *GP* demonstrates a discernible evolution in Desmarest's thought, however, is in relation to how physical geography should address the past. While his 1757 essay incorporated the recognition that the field's business included the Earth having undergone alteration (noting the immense deposits of fossil shells in Touraine, and enumerating a series of phenomena indicative of change), these considerations were asserted more than developed. *GP* conveys far more interest in enlarging on how one might extract meaning about past conditions and events from extant features. At least in retrospect, one sees great promise in Desmarest's effort to distinguish past *époques* through the practice of 'analyzing backward' in time through incremental stages.³² However, this tantalizing element of Desmarest's thinking—by which one supposes he might have imagined the possibility of organizing parts of physical geography around sequences of events—was not brought to the forefront in *GP* to the extent of its acquiring a guiding place among the field's purposes. Desmarest seems never to have overcome his fundamental conviction in a science founded on the natural world's order, rather than on historical developments.

The predominantly explanatory agenda in plain view within *GP* had its own past deeply embedded in Desmarest's development as an investigator of *terrain*, conceived as part of the natural order, as distinct from the setting for human existence. Like many eighteenth-century naturalists, Desmarest aspired to an Earth science that followed the patterns of natural philosophy. His scientific goals consistently tended toward universality. This strong orientation toward a goal of scientific explanation almost inevitably disabled him from taking any leading role in—and possibly even from gaining a clear perception of—the contemporary movement within Earth science disposed to prioritize historical development as a chief organizing principle. Even though he was a player in the broader framework of the 'geohistorical revolution', because of the way he placed himself epistemologically Desmarest's role in it could only lie somewhat away from its center (Rudwick 2005).

APPENDIX

Instances of plagiarism in Desmarest's *Géographie-Physique*, Volume 2: articles wholly or partly copied or adapted, without attribution, from other publications. This tabulation is not comprehensive. Not included are some articles in which the extent of plagiarism detected is comparatively slight. Cases in which Desmarest made some sort of acknowledgement, even where it was incomplete or obscure, are also excluded. The author's efforts to discover instances

³² As Steno had done so notably in his celebrated *Prodromus*.

of plagiarism (using the Google internet search engine) have been extensive, but certainly not exhaustive. Sources shown are referred to as 'apparent' since certain texts were published in multiple forms. This applies most obviously to texts appearing in the various editions of the *Encyclopédie* or of dictionaries such as Valmont de Bomare's. But sometimes one finds that a given text appears in more than one place—one example is seen in the article 'Airole' (Airolo, south of the St Gotthard Pass in the Swiss Alps), which Desmarest may have derived from either La Borde (1780) or Besson (1786), or possibly even from the same text's appearance in some different publication altogether. This practice suggests that Desmarest's willingness to borrow liberally from other authors probably was not unusual for its time.

Articles, pages	Apparent sources
Abreuver: 12b–22b	<i>Encyclopédie, Supplément</i> . Vol. 1, 1776, pp. 46–53.
Accessibilité des montagnes: 59a–60a	Louis-François Ramond, <i>Observations faites dans les Pyrénées</i> . Paris, 1789, pp. 322–328.
Açores (Îles): 148a–151a	James Cook, <i>Voyage dans l'hémisphère austral, et autour du monde</i> . Vol. 4, Paris, 1778, pp. 194–204.
Adersbach: 154b–155b	'Description des rochers d'Andersbach [<i>sic</i>] en Bohême', <i>Bibliothèque britannique, Sciences et arts</i> , Vol. 9, 1798, pp. 291–295.
Adour: 159b–169b	Opening portion (159b–161a) from Jean-Joseph Expilly, <i>Dictionnaire géographique, historique, et politique des Gaules et de la France</i> . Vol. 1, Avignon, 1763, pp. 16–17.
Afrique: 184b–192b	<i>Encyclopédie</i> , Vol. 8, 1765, pp. 346–347 (for section 'peuples'); <i>Encyclopédie</i> , new edn (Geneva), Vol. 36 (1779), pp. 443–444 (for section 'climat').
Agathe: 192a–195b	Jacques-Christophe Valmont de Bomare, <i>Dictionnaire raisonné universel d'histoire naturelle</i> , Vol. 1, Paris, 1764, pp. 75–79.
Aigle: 211b–212b	<i>Encyclopédie</i> , Vol. 14, 1765, pp. 555–556.
Aimant: 215a–220b	<i>Encyclopédie</i> , Vol. 16, 1765, pp. 841–845.
Air des montagnes. II: 227a–229b	Louis-François Ramond, <i>Observations faites dans les Pyrénées</i> . Paris, 1789, pp. 337–339.
Airole: 234a–237a	Jean-Benjamin de La Borde, <i>Tableaux topographiques, pittoresques, physiques, historiques, moraux, politiques, littéraires, de la Suisse et de l'Italie</i> . Vol. 1, Paris, 1780, pp. xxviii–xxxii. Also Alexandre-Charles Besson, <i>Manuel pour les savans et les curieux qui voyagent en Suisse</i> , Vol. 1, Lausanne, 1786, pp. 183–205.
Albâtre: 256a–260b	Closing portion (259a–260b) from Charles Latapie, 'Description abrégée de la manufacture de bas-reliefs en albâtres factices des bains de Saint-Philippe en Toscane', <i>Observations sur la physique</i> , Vol. 7, 1776, pp. 453–457.
Albi: 261b–266a	Antoine de Genssane, <i>Histoire naturelle de Languedoc</i> , Vol. 5, 1779, pp. 248–302.
Albinos: 266a–b	<i>Encyclopédie</i> , Vol. 11, 1765, p. 79; and <i>Encyclopédie</i> , new edn, Geneva, Vol. 2, 1777, p. 27.
Alcarrazas: 266b–268a	Lasterie [Charles-Philibert de Lasteyrie du Saillant], "Manière de fabriquer les alcarrazas," <i>Bulletin des Sciences, de la Société Philomathique</i> . Paris, Germinal, an 6 (Mars 1798), p. 103.
Alet: 275a–278b	Antoine de Genssane, <i>Histoire naturelle de la province de Languedoc</i> , Vol. 4, 1778, pp. 150–189.
Almaden: 297a–b	William Bowles, <i>Introduction à l'histoire naturelle et à la géographie physique de l'Espagne</i> , Paris, 1776, pp. 39–45.
Alpes: 299b–315b	Portions derived from <i>Géographie Moderne</i> of <i>Encyclopédie Méthodique</i> , Vol. 1, 1782), p. 56; Fortunato Barthélemy de Felice, <i>Encyclopédie, ou dictionnaire universel raisonné des connoissances humaines</i> , Vol. 39, Yverdon, 1775, p. 529; Jean-Baptiste Robinet, <i>Dictionnaire universel des sciences morale, économique, politique et diplomatique</i> , Vol. 29, Londres, 1783, pp. 3, 4; Didier Robert de Vaugondy, <i>Dictionnaire géographique, historique et politique de la Suisse</i> , Vol. 1, Neuchâtel, 1775.
Alsace: 335a–337b	Philippe-Frédéric, Baron de Dietrich, <i>Description des gîtes de minerais, & bouches à feu du Royaume</i> , excerpted in <i>Journal des Sçavans</i> , March 1789, pp. 159–171.
Altorf: 338b–340b	Jean-Benjamin de La Borde, <i>Tableaux topographiques, pittoresques, physiques, historiques, moraux, politiques, littéraires, de la Suisse et de l'Italie</i> , Vol. 1, Paris, 1780, pp. xxxiii–xxxiv [as quoted in James Hutton, <i>Theory of the Earth</i> , Vol. 2, pp. 119–136].

Amérique: 367b–469b [N Am, 367b–445a; S Am, 445a–469b]	Portions (376a–390b) from Charles Pictet, <i>Tableau de la situation actuelle des États-Unis d'Amérique, d'après Jedediah Smith et les meilleurs auteurs américains</i> , Vols. 2 and 3, an III (1795). Esp. I: 248–255, 265–268, 274–285, 291–295, 299–305, 311, 327–329, 332, 340, 345–347; and II: 7–22, 45–47, 50, 54, 59, 68, 75–79, 111–113, 118–121, 125–127, 132–135, 151, 160–176, 200 ff, 219 ff.; Also from Antonio de Ulloa, <i>Mémoires philosophiques, historiques, physiques, concernant la découverte de l'Amérique, ses anciens habitants, leurs moeurs, etc.</i> , Vol. 1, Paris, 1787.
Amis (îles des), 478b–482a	James Cook, <i>Troisième voyage de Cook, ou voyage à l'Océan pacifique ordonné par le roi d'Angleterre</i> , Vol. 2, Paris, 1785, pp. 54–57.
Andalousie: 517b–521b	Portions from Edme Mentelle, <i>Géographie comparée, ou analyse de la géographie ancienne et moderne des peuples de tous les pays et tous les âges</i> . Vol. 4, <i>Espagne ancienne</i> , Paris, 1781, pp. 109–114. Also from William Bowles, <i>Introduction à l'histoire naturelle et à la géographie physique de l'Espagne</i> , Paris, 1776, pp. 419–429.
Angaraez: 586b–588b	Antonio de Ulloa, <i>Mémoires philosophiques, historiques, physiques, concernant la découverte de l'Amérique, ses anciens habitants, leurs moeurs, etc.</i> , Vol. 1, 1787, pp. 29–34.
Antilles, 662b–674b	A portion from Guillaume-Thomas Raynal, <i>Histoire philosophique et politique des établissements et du commerce des Européens dans les deux Indes</i> , Vol. 3, Geneva, 1780, pp. 6–8.
Arabie: 706a–714a	Opening part (706a–707b) from <i>Encyclopédie</i> , new edn, Geneva, Vol. 3, 1777, pp. 120–123. Closing segment from Guillaume-Thomas Raynal, <i>Histoire philosophique et politique des établissements et du commerce des Européens dans les deux Indes</i> , Vol. 1, Geneva, 1780, pp. 288–289.
Aure ou Rivière de Verneuil: 866a–867b	Jean-Étienne Guettard, “Mémoire sur plusieurs rivières de Normandie, qui entrent en terre & qui reparoissent ensuite, & sur quelques autres de la France”, <i>Mémoires de l'Académie Royale des Sciences</i> , 1758 [1763], pp. 271–317 (esp. pp. 284–288).
Avranchin: 893b–895a	Jean-Paul Grandjean de Fouchy, “Sur les salines de l'Avranchin”, <i>Histoire de l'Académie royale des Sciences</i> , 1758 [1763], pp. 5–13 (summary by the Academy's perpetual secretary of Jean-Étienne Guettard, “Description des salines de l'Avranchin en Basse Normandie”, <i>Mémoires de l'Académie Royale des Sciences</i> , 1758 [1763], pp. 99–118).

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